paragraphs of page 1, lines 1-10; page 3, lines 6-18; and page 6, lines 6-17 for the corresponding paragraphs on file. A marked-up version showing the changes made is attached also.

IN THE CLAIMS:

Claims 1-4 are cancelled. Please add new claims 5 to 7 to the specification.

IN THE ABSTRACT:

Please add the attached Abstract of the Disclosure to the specification.

REMARKS

Claims 5 to 7 are in the application; claims 1-4 are cancelled.

In order to conform the specification to standard U.S. patent practice, proper headings pursuant to MPEP 608.01(a) have been introduced into the specification. Also, an Abstract of the

Disclosure is provided herewith to be added to the specification. Reference to the claims in the text of the specification has been eliminated.

The disclosure is objected to because of informalities: the examiner refers to the term "hasp temperature" on page 2, line 2 of 3rd paragraph. It is respectfully submitted that this term is correct: the material is wound onto a hasp after manufacture and the hasp temperature is the temperature at which the strip is wound onto the hasp.

Claim 1 is objected to because of informalities. Claim 1 is cancelled and new claim 5 has been reworded in view of the examiner's objection.

Reconsideration and withdrawal of the rejection of claims 1 and 2 under 35 U.S.C. 102(b) as being anticipated by Japanese patent abstract 57-104650A and under 35 U.S.C. 103(a) as being unpatentable over EP 0 747 495 is respectfully requested.

New claim 5 is directed to a method for manufacturing dual-phase steels of a dual-phase microstructure of 70-90 % ferrite

and 30-10 % martensite form the hot-rolled state via controlled temperature guiding and defined cooling strategy. Cooling is achieved in two steps, wherein in the first cooling stage cooling is carried out at a slow first cooling rate and, subsequently, at a second cooling rate that is faster than the first cooling rate, cooling is carried out such that the cooling curve first enters the ferrite range and is then guided below the martensite starting temperature. According to the object of the invention, the measures for a quick and quantitative microstructure transformation of the austenite into ferrite unitary high strip speeds are to be provided.

The object is solved according to the invention in that the first cooling stage is carried out in a cooling stretch of water cooling stages arranged successively at a spacing behind one another at a cooling rate of 20-30 K/s, wherein the cooling curve enters the ferrite range with still such a high temperature that ferrite formation can take place quickly, and wherein, before beginning the second cooling stage which follows without intermediate air cooling and holding time directly after the first cooling step, already at least 70 % of the austenite has been transformed into ferrite and during the transformation of

the austenite into ferrite up to the desired ferrite contents of at least 70 % the cooling of the first cooling step is continued.

With the method according to the invention, providing a slow cooling in the cooling stretch wherein water is applied to the steel to be cooled by means of the water cooling stages arranged at a spacing sequentially one after another ("dispersed cooling"), it is possible, by selecting the number of water cooling stages, the spacing from one another as well as the effective length of the cooling stages, to adjust the cooling rate or the applied amount of water optimally to the steel to be cooled. By means of the adjustment of the quantity of cooling medium relative to the steel to be cooled, the first cooling step can be extended temporally until the desired degree of transformation has been achieved without there being the risk, as is known in the prior art, that the cooling curve for a cooling action that is too intensive already leaves the ferrite range.

The cited prior art EP 0 747 491 discloses a method wherein a steel sheet of high-strength of a microstructure of at least 75 % ferrite, at least 10 % martensite, and optionally bainite and residual austenite is produced. This method is thus not at all

suitable for manufacturing a pure **dual-phase steel**. In regard to the method itself, it should be noted that cooling of hot-rolled steel sheet is described wherein a slow cooling is followed by a quick cooling or, alternatively, a quick cooling precedes the slow cooling stage. Cooling rates, cooling duration, and cooling ranges and temperature ranges are disclosed up to which the cooling is to be carried out. The cooling temperature ranges which can be calculated with the provided numerical values range from 16°C (2°C/sec cooling rate and 8 sec cooling duration) to 600°C (15°C/sec cooling rate and 40 sec cooling duration) and therefore do not teach a person skilled in the art how the cooling of the first cooling stage is to be performed in order to reach the desired transformation degree. With 2 up to 15°C/sec the cooling rate is considerably slower than the corresponding cooling rate of the invention with 20-30 K/sec (a very slow cooling rate is disadvantageous with respect to high strip speeds).

The Japanese abstract 57-104650A describes a method for producing a hot-rolled steel sheet which is comprised of ferrite of an undisclosed proportion and martensite of a proportion of 1-30 %. For producing this steel sheet, cooling is first carried

out to a temperature between the Ar1 point and 550°C at a rate of 5-30°C/sec and subsequently a faster cooling stage with a cooling rate of greater than 30°C/sec down to a temperature in the range of 350 to 500°C is carried out.

The methods of the two cited prior art documents have in common that cooling of the first slow cooling stage to the disclosed temperature range is guided according to the European document between the Ar1 point and 730°C and according to JP 57-104650 between the Ar1 point and 550°C without there being any information which degree of transformation from austenite to ferrite has been achieved.

In contrast, the method according to the invention carries out the first cooling stage until at least 70 % of the austenite is transformed into ferrite without limiting the temperature values in any way. Moreover, the slower cooling in the method according to the invention is realized by a so-called dispersed cooling. By means of the water cooling stages arranged at a spacing sequentially behind one another, an optimal adaptation of the cooling action to the desired transformation is possible independent of the strip transport speed and the strip geometry.

In the two cited prior art references, there is no suggestion in regard to the type of cooling in the first slow cooling stage. Even though for the first cooling stage different cooling rates are disclosed there is no explanation as to how these different values are realized. However, in addition to the change of cooling medium quantities, the strip speed and the strip geometry also have a decisive influence on the cooling results.

Therefore, new claim 5 is not anticipated by or obvious in view of the cited prior art.

Reconsideration and withdrawal of the rejection of claims 2 and 3 (the examiner apparently means claims 3 and 4) under 35 U.S.C. 103(a) as being unpatentable over JP 57-104650A or EP 0 747 495 in view of Umeno et al. (US 4,591,133) or Plata et al. (US 5,382,306) is respectfully requested.

Claims 3 and 4 have been cancelled and replaced with claims 6 and 7.

The secondary prior art documents which are applied by the

examiner to the device claims appear to be far removed from the subject matter of the present invention. The following should be noted. In the document U.S. 5,382,306 cooling of products of aluminum or aluminum alloys by means of an extrusion device is described wherein with water/air nozzles the extrudate is cooled to approximately 575°C. A cooling rate is not disclosed.

In the document U.S. 4,591,133 the cooling of large size steel plates is described wherein cooling is carried out from 800°C to 50 up to 110°C. This document also does not provide any information in regard to the cooling rate.

Therefore, in view of the foregoing, it is submitted that this application is now in condition for allowance and such allowance is respectfully solicited.

Any additional fees or charges required at this time in connection with the application may be charged to Patent and Trademark Office Deposit Account No. 11-1835.

Respectfully submitted,

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Dated: March 5, 2002
Encl.: new claims 5-7; amended pages 1, lines 1-10; page 3, lines 6-18; page 6, lines 6-17 (clean copy and marked-up version); Abstract of the Disclosure

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231, on March 5, 2002

By: Fr Kf
Friedrich Kueffner

Date: March 5, 2002

~~NEW CLAIMS 5-7~~

5. A method for producing dual-phase steels from the hot-rolled state with a two-phase microstructure of 70 % to 90 % ferrite and 30 % to 10 % martensite by a controlled temperature guiding and defined cooling strategy during the cooling of the steels, inter alia by means of water cooling after their finish rolling, wherein in a first cooling stage at a first slow cooling rate the cooling curve enters the ferrite region and in a second cooling stage at a second cooling rate faster than the first slow cooling rate further cooling is carried out to temperatures below the martensite starting temperature, the method comprising the steps of:

carrying out the first cooling stage at a cooling rate of 20-30 K/s in a cooling stretch comprised of several water cooling stages positioned successively at a spacing from one another;

allowing the cooling curve in the first cooling stage to enter the ferrite region at a temperature still so high that the ferrite formation takes place quickly; and,

before beginning the second cooling stage, which follows without intermediate air cooling and holding time directly after the first cooling stage, transforming already at least 70 % of the austenite to ferrite by continuing cooling of the first cooling stage during the transformation of the austenite into ferrite up to the desired ferrite contents of at least 70 %.,

6. A device for performing a method for producing dual-phase steels from the hot-rolled state with a two-phase microstructure of 70 % to 90 % ferrite and 30 % to 10 % martensite by a controlled temperature guiding and defined cooling strategy during the cooling of the steels, inter alia by means of water cooling after their finish rolling, wherein in a first cooling stage at a first slow cooling rate the cooling curve enters the ferrite region and in a second cooling stage at a second cooling rate faster than the first slow cooling rate further cooling is carried out to temperatures below the martensite starting temperature, wherein the first cooling stage is carried out at a cooling rate of 20-30 K/s in a cooling stretch comprised of several water cooling stages positioned successively at a spacing from one another, wherein the cooling curve is allowed to enter the ferrite region at a temperature still so high that the ferrite formation takes place quickly, and, before beginning the second cooling stage, which follows without intermediate air cooling and holding time directly after the first cooling stage, already at least 70 % of the austenite is transformed to ferrite by continuing cooling of the first cooling stage during the transformation of the austenite into ferrite up to the desired ferrite contents of at least 70 %; the device comprising a cooling stretch arranged behind the last finish roll stand (1) and having several water cooling stages (7) positioned successively at a spacing from one another.

B1

7. ~~The device according to claim 6, wherein the number of water cooling stages, an effective length of the water cooling stages, and the spacing from one another are changeable or continuously adjustable in the case of quantity control.~~

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B1

CLEAN COPY OF AMENDED PAGE 1, LINES 1-10, OF TRANSLATION OF WO 00/05422

B2 Method and Installation for Producing Dual-Phase Steel

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a method and a device for producing dual-phase steel with a two-phase microstructure of 70 to 90 % ferrite and 30 to 10 % martensite from the hot-rolled state by a controlled temperature guiding and defined cooling strategy during the cooling of the steels, inter alia by means of water cooling after their finish rolling, wherein in a first cooling stage the cooling curve enters the ferrite region and, after reaching the required ferrite contents, further cooling to temperatures below the martensite starting temperature is carried out in a second cooling stage.

2. Description of the Related Art

CLEAN COPY OF AMENDED PAGE 3, LINES 6-18, OF TRANSLATION OF WO 00/05422

SUMMARY OF THE INVENTION

Based on this known prior art, it is an object of the invention to provide a method and a device for producing dual-phase steel wherein a fast and quantitatively sufficient structural transformation of the austenite into ferrite is possible even at high strip speeds.

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The above object is solved according to the invention in that during the first cooling stage the cooling curve of the steels is adjusted with such a low cooling speed of 20 K/s to 30 K/s that the cooling curve enters the ferrite region with a temperature still so high that the ferrite formation can take place quickly and that already at least 70 % of the austenite has been transformed into ferrite before the beginning of the second cooling stage.

CLEAN COPY OF AMENDED PAGE 6, LINES 6-17, OF TRANSLATION OF WO 00/05422

B4

BRIEF DESCRIPTION OF THE DRAWINGS

Further advantages, details, and features of the invention result from the following description of an embodiment schematically illustrated in the drawings.

It is shown in:

Fig. 1 a schematic illustration of the fast cooling and the dispersed cooling as well as their arrangement in a mill train;

Fig. 2 a time-temperature-transformation curve;

Fig. 3 the degree of austenite transformation for fast transformation;

Fig. 4 the degree of austenite transformation for dispersed cooling.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

MARKED-UP VERSION OF PAGE 1, LINES 1-10, OF TRANSLATION OF WO 00/05422

Method and Installation for Producing Dual-Phase Steel

BACKGROUND OF THE INVENTION

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The invention relates to a method and a device for producing dual-phase steel with a two-phase microstructure of 70 to 90 % ferrite and 30 to 10 % martensite from the hot-rolled state by a controlled temperature guiding and defined cooling strategy during the cooling of the steels, inter alia by means of water cooling after their finish rolling, wherein in a first cooling stage the cooling curve enters the ferrite region and, after reaching the required ferrite contents, further cooling to temperatures below the martensite starting temperature is carried out in a second cooling stage.

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The above object is solved according to the invention ~~with the characterizing measures of claim 1~~ in that during the first cooling stage the cooling curve of the steels is adjusted with such a low cooling speed of 20 K/s to 30 K/s that the cooling curve enters the ferrite region with a temperature still so high that the ferrite formation can take place quickly and that already at least 70 % of the austenite has been transformed into ferrite before the beginning of the second cooling stage.

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DESCRIPTION OF THE PREFERRED EMBODIMENTS